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ABSTRACT

An investigation was conducted comparing six college students who used cognitive mapping to two control groups, each with five students, who used a self-selected study strategy and reading. Cognitive mapping is a study strategy that displays the meaning of text through a diagram depicting the interconnectedness of the ideas in the text. Results from an analysis of covariance, using the total score from a standardized reading test as the covariate, showed no significant differences between groups on the delayed retention of information for each of three question types--main idea, subcategories, and details. Although students in the mapping group had the lowest mean on the standardized reading test, they achieved the highest mean on each question type. This was an interesting result in light of the fact that the mapping group received only two 50-minute instructional sessions with the mapping strategy, whereas students in the self-selected strategy group were allowed to use their preferred strategy, one developed over a long period of time. These results indicated that mapping may have potential as a study strategy. (Author/RL)

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COGNITIVE MAPPING: UNDERSTANDING, ORGANIZING, AND REMEMBERING WRITTEN DISCOURSE

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Helping students built a repertoire of study strategies is one of the basic functions of a study skills course. A review of the literature indicates that cognitive mapping of information can be one of the most useful strategies students may employ to comprehend and retain information (Hanf, 1971; Rosenblatt, 1975; Driskell, 1977; Armbruster & Anderson, 1980; Anderson & Armbruster, 1980; Solon, 1980). Thus, cognitive mapping was one of the major study strategies introduced in a Reading and Study Skills course.

Definition

Mapping is a strategy used to display the meaning of text through a diagram depicting the interconnectedness of the ideas in the text. The information which each student selects to map is dictated by three basic factors. One, the student's purpose for reading is important. The student may not only wish to pass the test but also to build additional background to be utilized later. Two, the student may have an extensive or limited background regarding the information to be learned. If background is extensive, the student may be able to map the information in the text and also associate the material with known information in memory. But, if background is limited, the student may experience difficulty in merely mapping the information. Three, the instructor may wish the student to focus on particular information in the text. Therefore, this information may be emphasized and elaborated upon in the map.

Review of the Literature

Armbruster and Anderson (1980) presented four areas of research supporting the contention that mapping is an important study strategy.

The first area Armbruster and Anderson presented included research on adjunct questioning. In addition, the writers propose that research designed to train students to generate their own questions is relevant. For example, results from an investigation by Andre and Anderson (1978-79) indicated no significant difference between a question trained group and a control group for one experiment. However, the types of questions the high school subjects generated did have an effect. Good text based questions resulted in a higher probability of achieving a higher post test score. Results from a second experiment showed that the question trained group and the question untrained group did significantly better than the control group. The researchers hypothesized that a possible reason for the question generating groups scoring higher was that generating questions forced the subjects to process the text at a deeper semantic level. This conclusion was congruent with the conclusion Armbruster and Anderson drew from their review of investigations using adjunct questioning.

The second area of research Armbruster and Anderson (1980) presented supporting mapping was research on text structure. This research was divided into two parts: (1) research focusing on the effect text structure has on recall and (2) research focusing on the facilitative effect prior knowledge has on recall.

A further review of the literature reveals research indicating that the difficulty of a text is dependent upon many factors. Kintsch and Keenan (1973) demonstrated the number of propositions (ideas) per sentence was one of the factors. Kintsch, Kozminsky, Streb, McKoon, and Keenan (1975) replicated these results and, in addition, showed that

the number of different arguments within a text base was also a factor contributing to the difficulty of comprehending written discourse. Keenan and Kintsch (Kintsch, 1974) indicated that identifying statements which represent propositions (ideas) explicitly contained in the surface structure of the text is an easier task than identifying statements which represent propositions implied in the text. Further, and investigation by Marshall and Glock (1978-79) regarding the relationship between the structure of descriptive discourse and recall suggested that fluent readers in their study comprehended the semantic structure regardless of the surface structure of the text, while less fluent readers relied upon surface structure to cue the semantic structure. Thus, these studies indicate that text structure does have an effect on recall and comprehension.

In addition, Armbruster and Anderson proposed that background knowledge is extremely important. A schema theory view of reading contends that prior knowledge which includes knowledge a person has about concepts, events, and sequences of events facilitates comprehension. The prior knowledge may serve as an anchoring post for incoming information, thus increasing the probability that a message will be understood. Subjects in the experimental groups in some studies were provided with contextual cues such as pictures or thematic titles to passages (Bransford & Johnson, 1972; Schallert, 1976; Dooling & Mullett, 1973; Sulin & Dooling, 1974; Dooling & Christiaansen, 1977). The purpose of this procedure was to induce subjects to instantiate an appropriate schema to which the incoming information could be anchored or assimilated. Results of these studies support the contention that a

reader's prior knowledge has a facilitating effect on comprehension and recall.

The last area of research reviewed by Armbruster and Anderson (1980) indicated that subjects who read diagrams with or without texts achieved a higher level of performance on multiple-choice posttests than the control group who read just the text.

Next, Armbruster and Anderson (1980) directly investigated the effectiveness of mapping on reading comprehension of eighth grade students. Eleven students received approximately twelve hours of instruction in mapping expository prose. Results revealed that students in the mapping group recalled significantly more information after 24 hours than students in the control group who used their own method of reading. The results approached significance on the immediate recall of the second passage. In addition, it was found that the probability of recall was higher for mapped than unmapped information.

In summary, research seems to indicate that mapping is an important study strategy for several reasons. First, the reader must be an active participant in the learning process. Second, mapping requires the reader to process the information at a deeper level. Third, the reader may obtain an overall picture of the information, not just bits and pieces of information; that is, the reader may obtain a framework from which to proceed in the learning process.

Instructional Procedure

Most writers employ a combination of organizational thought patterns in their writing and it can be difficult for the reader to separate the information into the patterns. Therefore, the instructional

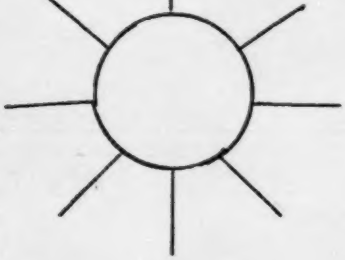
procedure based on Hanf (1971) and Hansen, Herlin, Mayfield, Osborne, and Vance (1975) was selected because it appeared to represent the most direct and least confusing procedure to explain to students. Subsequently, in training students to map information, this instructional procedure has shown to be most easily understood by students.

The instructional procedure began with a definition of what mapping entailed, plus three basic questions to be answered by the student when mapping began:

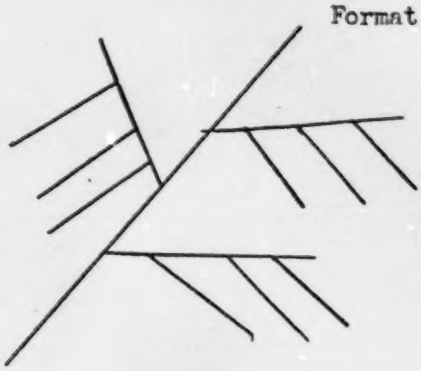
1. Identify the subject/topic of the discourse
2. Identify the subcategories/ideas of the discourse
3. Identify the details of the discourse

Secondly, the students then read a paragraph representing concrete type information and were given four formats which could be used to diagram the information when answering the three basic questions. The paragraph and diagrams are discussed in the text, Critical Reading (Hansen, Herling Mayfield, Osborne, & Vance, 1975, pages 271-276).

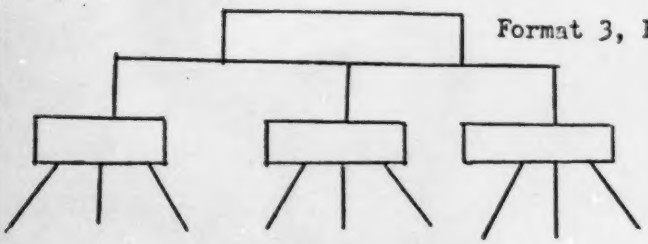
Format 1, Sunburst



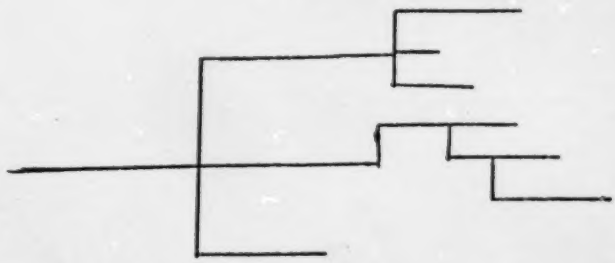
Format 2, Leaning Tree



Format 3, Flowchart[1]



Format 4, Flowchart[2]



A mapping aspect emphasized in the introduction was that mapping allows large amounts of information to be condensed on, for example, a single page. This highly condensed information may lessen the need to reread much of the subject matter. Instead, key words may trigger associations when reviewing the material. If the student includes page numbers next to the subcategories (question two) and details (question three), the map will also serve as a table of contents if a more thorough review of selected areas is required at a later time.

As a third step, students mapped information from a paragraph representing concrete information. Students selected the format; either one of the four presented in the introductory session or one of their own creation. In addition, students were encouraged to use their own innovative ideas such as the use of color, shapes, and pictures to aid in recall of the material. After discussing the mapped information from the paragraph, students were assisted in mapping material from chapter four, How to Study in College (Pauk, 1974). In this initial effort, students were taught to use the author's (Pauk's) outline in constructing their map. Chapter six in this text was also mapped.

Finally, as a fourth step, students were directed to map a chapter in one of their other textbooks. These maps were discussed in class and it was pointed out that deciding where information is placed on a map demands creativity, selectivity, organization, and critical evaluation of the information on the part of the student.

Research Project

Mapping is a relatively new study strategy; therefore, a research project was designed to compare mapping with two other study strategies,

reading and student self-selected strategy. Specifically, the purpose of this project was to determine the effectiveness of each study strategy on the delayed recall of information.

Sixteen college age students enrolled in a Reading and Study Skills course were randomly assigned to one of three groups. The six students in the experimental group, mapping, were taught individually or in groups of two. Instruction was divided into two fifty minute sessions and was identical to the procedure explained above. In the first session steps one through three were followed; in the second session, step four was followed.

The five students in control group one, self-selected strategy, and the five students in control group two, reading, did not receive individual or small group instruction. The self-selected strategy group was included for two reasons. One, research suggests that teaching a student a strategy will be better than no instruction (Sloan & Pearson, 1978). Therefore, it would not be surprising to find mapping a better strategy than reading. Two, students at the college level should have had years to perfect an individual system, a preferred study strategy. If the mapping strategy with only two fifty minute instructional sessions could be found to compare favorable with student selected strategy, then mapping could be considered to be a useful strategy. All the students had taken the Nelson-Denny Reading Test, Form D (Brown, Nelson & Denny, 1973). Table 1 presents the results for each group.

During one class period, a Tuesday, all the students were given the paragraph to read, Figure 1 presents the paragraph and Figure 2 presents the map of the paragraph. The directions per each group were as follows:

Mapping Group
Please read and map the information. Remember how you mapped information previously. On Thursday you will be asked questions on the information. You will have ten minutes. If you are done before the ten minutes are up, please continue with other work. Work quietly.

Self-Selected Strategy Group
Please read the information. On Thursday you will be asked questions on the information. You may elect to use the study strategy of your choice, for example, underlining or highlighting. You will have ten minutes. If you are done before the ten minutes are up, please continue with other work. Work quietly.

Reading Group
Please read this information. On Thursday, you will be asked questions on the information. You will have ten minutes. If you are done before the ten minutes are up,please continue with other work. Work quietly.

On the following class period, a Thursday, all the students received the same instructions.

Last class period you were directed to read information. You were told you would be asked questions on this information. Please answer the following questions. Use your own paper. Write you name on the paper. When you are finished, place your sheet in your folder.

1. What was the topic/subject discussed?
2. What were the subcategories/ideas discussed?
3. What were the details?

Each question was scored separately and the scoring procedure was as follows. Question one received a zero for an incorrect answer and a one for a correct answer. On question two the scoring was zero to four. On question three there were 19 possible details; therefore, the points could range from zero to 19.

An analysis of covariance, using the total score from the Nelson-Denny Reading Test as the covariate, revealed no significant differences between groups on each of the three questions. However, it was interesting to note that students in the mapping group scored the lowest on the reading test but scored the highest on each question (see Table 1).

It was not surprising to find that the students in the mapping group had a higher level of performance than the students in control group two, reading. The real question of interest was how mapping would compare with control group one, self-selected strategy. Four students in this group elected to underline and write some notes on the test paragraph; one student elected only to underline. Results revealed that the mapping group with only two fifty minute instructional sessions achieved a higher mean score on each question. Therefore, at least for the students involved in the mapping group in this study, it appears reasonable to assume that mapping information had a facilitative effect on delayed recall.

Summary

Mapping appears to be an effective strategy; however, it should be noted that certain factors may cause difficulty when mapping information. Abstract information is more difficult to map than concrete information. The organizational pattern of the information may be extremely complex, requiring knowledge of structure and style. In addition, the student must have the ability to discern the difference between main ideas and details. Finally, the tendency for the novice mapper may be to either construct a very superficial map or a very extensive map and either type of map may be inappropriate for the purpose set by the student.

Further research needs to be conducted on the efficacy of mapping as a study strategy. Questions to be answered include determining the effectiveness of mapping (1) on retention of abstract information versus concrete information, (2) on retention of information from varied disciplines, (3) as a strategy when studying for different test

types, multiple choice or essay, and (4) for students with limited or extensive backgrounds.

TABLE 1

Group	Nelson-Denny Reading Test						Questions					
	Vocabulary		Comprehension		Total		Main Ideas		Subcategories		Details	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Mapping Group	20.33	(6.59)	31.67	(10.54)	52.0	(16.79)	1.0	(.0)	3.17	(.75)	5.67	(2.58)
Self-Selected Group	27.8	(16.93)	34.8	(8.32)	62.6	(24.48)	.8	(.45)	2.20	(1.79)	4.8	(5.07)
Reading Group	29.4	(22.59)	37.2	(19.93)	66.6	(37.33)	.8	(.45)	2.20	(1.79)	4.6	(4.34)

The survival of a Reading Center within a college setting depends upon several factors, including political, staffing, service, and awareness factors (Shelton, 1980). The political factor is important. The persons in power within the college must be committed to the objectives of the Center in order for the Center to be funded. The Reading Center staff includes both clerical and professional personnel. The professional staff must be knowledgeable of research and practical methods. The motivation and knowledge of the entire staff affects the extensiveness of services. Services may include individual and group instruction, outreach programs, and research. Students and faculty must be aware of the services of the Center. Therefore, the awareness factor is important. The services may be published through newspaper articles, messages on the college radio, brochures, and word-of-mouth.

Figure 1. Information read by students in each group.

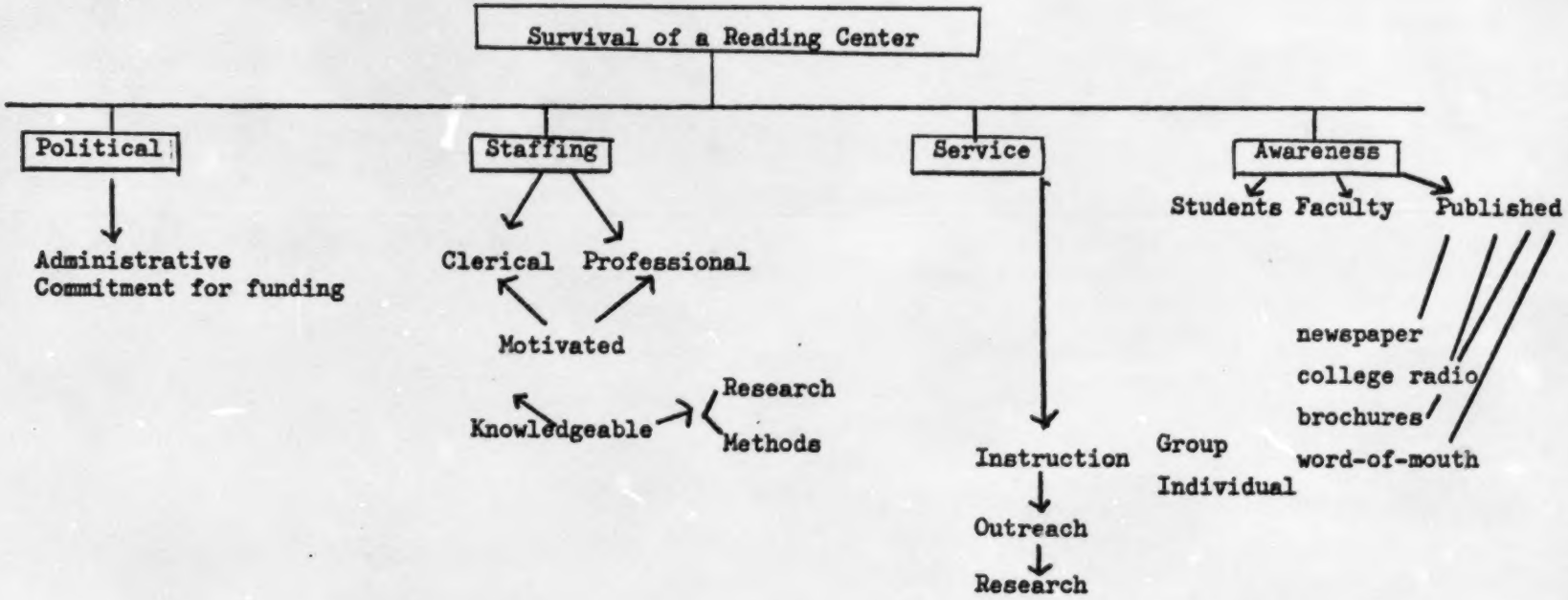


Figure 2. Map of the information read by students.

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